

## Fact Sheet: Alternative 1 – Large Core-Minimal Management



### Summary

The riparian conservation strategy of this alternative uses a habitat-based approach, with creation of large core habitat blocks (greater than 1,250 acres), using existing habitat for corridors, and with application of minimal management. The riparian conservation strategy also includes an integrated mosaic of marsh and upland habitats to achieve conservation goals. Fifty-four species are proposed for coverage under take authorizations issued under this alternative. An additional forty-three species would have research and monitoring programs implemented and they would be evaluated for coverage in the future under this alternative.

The aquatic strategy in this alternative utilizes augmentation of native fish populations in reservoirs, creates isolated refugia in the historic floodplain, and allows for periodic reconnection of the refugia and other habitats to the river system.

### Riparian Conservation Strategy: Large Cores/Minimal Management

#### Main theme

This alternative focuses on the development of large cores of riparian habitat to achieve conservation goals for riparian species. Core size would vary depending on a variety of factors including species biology, physical and engineering parameters, soils, groundwater, adjacent land use and the availability of lands. Based on

biological needs and preliminary physical/engineering evaluations of conservation areas on the river, large cores would be approximately 1,250 acres or greater. This acreage does not account for mesquite bosque which may complement the riparian woodland, marsh, and open water habitat mosaic. The LCR MSCP is continuing to evaluate the appropriate amount of acreage for riparian restoration. Currently, acreage estimates range from a low of 3,000 acres to a high of 80,000 acres of riparian woodland, marsh, open water, and mesquite habitat.

Conservation areas would be located along the mainstem of the Colorado River and throughout its historic floodplain. Some of the historic floodplain is being used for agriculture and could be available, on a voluntary basis, for restoration to native habitat. Figure 1 illustrates the location of potential restoration sites as well as estimated restoration acreage at selected sites.

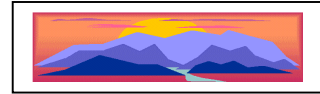
The conservation areas would consist of cores of land configured to minimize the ratio of habitat at the edge to that at the interior of the core. Large conservation areas have different properties because of their relatively decreased edge effect, than do small pieces of the same habitat.

The environment at the habitat edge penetrates into the habitat producing an “edge effect” which reduces the actual amount of usable habitat for some species.

Conservation areas would consist of a core of habitat in which target species would breed successfully surrounded by

## Fact Sheet: Alternative 1 – Large Core-Minimal Management

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a buffer of lesser value as breeding habitat, but not significantly different structurally than the core. Not all of the proposed covered species breed in the same habitat type, and a buffer area for one species could function as core habitat for another.

Large conservation areas would retain a larger portion of the habitat free from nest parasitism, because of the small edge to interior ratio. Conservation areas would be large enough to support nesting populations of target species. These new population members could then colonize habitat as it is created, move among habitat pieces, and re-colonize areas.

The conservation areas would be sited where physical conditions would be conducive to restoration or creation of a mix of habitat types such as forest, and open water. These conservation areas would include the transition between habitat types.

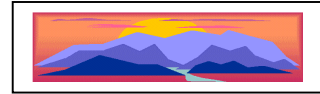
The LCR MSCP will identify areas along the historic floodplain for conservation. In order to achieve habitat restoration and creation objectives, a variety of engineering techniques will be evaluated to facilitate restoration of riverine function in selected reaches of the planning area, including offstream and the mainstem channel. These engineering techniques could include existing irrigation systems, wells, pumps, weirs, wing-walls, grade control structures, bankline/levee modification, diversion dams, conveyance canals, percolating or permeable dike structures, and other applicable flow diversion and routing techniques.

This alternative also includes using periodic flood control and space-building releases from upstream reservoirs of up to 40,000 cubic-feet-per-second in order to facilitate the restoration and creation of riparian habitat. A floodplain management program would be included under this alternative to minimize or avoid impacts to property. Focused bankline and levee modification or setback would be required in order to utilize this approach to restore or create riparian habitat in the historic floodplain, while minimizing or avoiding impacts to property. Preliminary engineering estimates indicate that this approach could result in the creation of approximately 3,000 acres of ephemeral habitat. Additional water under this alternative could be obtained from a variety of sources, for example through willing sellers or a water bank.

The riparian conservation strategy would also include a preservation component to complement the restoration component. Preservation would focus on existing habitat where target species are breeding successfully. Preferably, these areas would be located near areas being considered for conservation and restoration.

### Management

Larger conservation areas would reduce the need for intensive management because the conservation areas would maintain more of the natural ecosystem processes. For example, the vegetation growth, maturity, and senescence cycle would more closely mimic the natural cycle in large core areas versus smaller



core areas. Nest parasitism by cowbirds on target species may be reduced with more isolated nesting sites. Large areas of robust native vegetation would not be as vulnerable to encroachment by non-native plants as small areas. The need for fire management may also be reduced under this alternative when compared to other alternatives under consideration. As with all the alternatives under consideration, adaptive management would be a cornerstone of the overall management strategy under this alternative.

### **Habitat-Based Approach**

The habitat approach would simultaneously address the needs of the covered species by incorporating the components of the ecosystems (e.g., quantity and quality of breeding, wintering, and dispersal habitats) which would contribute to the recovery and persistence of the target species.

Habitat-based conservation will integrate the ecology of species and ecosystems. It is conservation based on protecting the capacity of an ecosystem to support and maintain a balanced, integrated, adaptive community having a species composition, and diversity comparable to that of other natural habitats in that region.

### **Corridors**

The primary function of corridors is to increase the movement of target species between core areas. Individuals may not spend much time in corridors, but they must be of a minimum quality to be used at all. Corridors decrease the isolation of habitats, which increases the persistence of their constituent species.

Connectivity to existing and future populations of target species on the LCR is important. Currently unoccupied habitat and restored areas would rely on corridors to facilitate colonization from source populations.

### **Monitoring**

All of the covered species would be monitored using a combination of habitat and species monitoring. Select species including those that are federally threatened or endangered would be monitored directly. A subset of other covered species would be monitored concurrently with the habitat to validate the habitat monitoring approach.

### **Aquatic Strategy**

#### **Main Theme**

The aquatic strategy includes augmentation of fish populations in reservoirs and the mainstem of the Colorado River to develop and maintain populations at target levels. This includes minimal manipulation to maintain positive population growth and genetic diversity. The aquatic strategy also includes the use of isolated refugia within the historic floodplain that are periodically re-connected to the mainstem of the Colorado River. Fish reared in hatcheries and released would be of a size to maximize survival.

#### **Isolated Refugia**

To enhance fish populations, several aquatic refugia would be created which are hydraulically isolated from the mainstem of the Colorado River, but within the historic floodplain of the



LCR. The primary reasons for the physical separation is to isolate young native fish from non-native predators. Reared fish would grow out in these backwaters and then be moved into the mainstem from time-to-time.

Some refugia would be stocked with larval or juvenile fish that would grow to adults and contribute to that population. Fish may be moved between backwaters to meet management goals.

### **Instream stocking**

Stocking of native fish into the mainstem of the Colorado River would include restoring and maintaining habitat quality within the mainstem. This includes improving water quality, modifying structural characteristics of the river, and control of predation and competition from non-native fish.

Habitat enhancement projects may include:

- retention of washfans to provide sediment to water;
- development of connected slow water areas (e.g., flooded bottomlands);
- increased habitat variability.

This alternative includes the provision to re-establish extirpated fish species consistent with species recovery goals and criteria, with potential regulatory provisions incorporated to minimize resource or recreational user conflicts.

### **Non-native fish control strategy**

Non-native fish control strategies would focus on protecting the integrity of refugia and site-specific actions in reservoirs and mainstem habitats. Options for control of non-native species include:

- development of focused commercial harvest or physical removal strategies for specific sites and species, consistent with applicable laws and regulations;
- liberalized harvest limits for nonnative fish in certain reaches of the LCR;
- control of giant salvinia;
- use of non-endangered native fish as bait to minimize the introduction of non-native baitfish into the LCR.

### **Management**

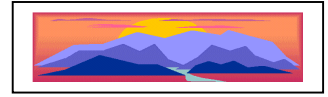
Large backwaters have a higher likelihood of containing habitat used by more age classes of fish than small backwaters. Additionally, large backwaters would contain more of the ecological components and processes than small backwaters, minimizing the need for active management of these areas.

### **Native Aquatic Species Management and Research Center**

In this alternative, a native aquatic species management and research center (Center) would be built which would be focused around the construction of a small hatchery used to produce native fishes in conjunction with existing hatcheries. This Center would utilize the exiting system of hatcheries which produce razorback suckers and bonytail chubs as satellite facilities and/or partner with agencies already growing fish to

## **Fact Sheet: Alternative 1 – Large Core-Minimal Management**

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contract with the Center. After the demand for juvenile fish decreases, the Center would be used to conduct research on fish. This Center would be used to study and captive breed target species of amphibians and invertebrates. This Center would also contain administrative offices, a visitor's center, and aquarium.



### Summary

The riparian conservation strategy of this alternative uses a habitat-based approach with creation of small core habitat blocks (approximately 250 to 1,250 acres) in conjunction with existing habitat for corridors and application of active management. Similar to Alternative 1, the riparian conservation strategy also includes an integrated mosaic of marsh and upland habitats to achieve conservation goals. Fifty-four species are proposed for coverage under take authorizations issued under this alternative. An additional forty-three species would have research and monitoring programs implemented and they would be evaluated for coverage under this alternative in the future.

The aquatic strategy in this alternative utilizes augmentation of native fish populations in reservoirs and creates isolated refugia without provision for periodic reconnection to the river system.

### Riparian Conservation Strategy: Small Cores/More Management

#### Main theme

Alternative 2 would use smaller parcels of land for conservation areas compared to Alternative 1.

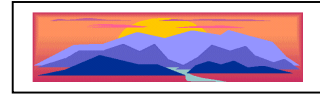
Core size may vary depending on a variety of factors including species biology, physical and engineering parameters, soils, groundwater, adjacent land use and the availability of lands.

Based on biological needs and preliminary physical/engineering evaluations of conservation areas on the river, small cores may be considered those which range from 250 to 1,250 acres. This acreage does not account for mesquite bosque which may complement the riparian woodland, marsh and open water habitat mosaic. The LCR MSCP is continuing to evaluate the appropriate amount of acreage for riparian restoration.

Currently, acreage estimates range from a low of 3,000 acres to a high of 80,000 acres of riparian woodland, marsh, open water, and mesquite habitat. The total amount of acreage could vary compared to Alternative 1 (because of more intensive management), but would be allocated differently across the landscape. Conservation areas would be located along the mainstem of the Colorado River and throughout its historic floodplain. The small patch size could be accommodated within the space adjacent to the mainstem with less voluntary conversion of agricultural lands than Alternative 1. Figure 1 illustrates the location of potential restoration sites as well as estimated restoration acreage at selected sites.

Conservation areas would contain a core of breeding habitat surrounded by a buffer of habitat that could be used as breeding by species with similar habitat requirements. The main difference in the size of conservation areas between Alternatives 2 and 1 would be the number of territories proposed for each conservation area. The conservation areas would contain a variety of habitats

## Fact Sheet: Alternative 2 – Small Core-Additional Management



(e.g., backwaters, marshes, and forests), where possible.

The total acreage for conservation would be allocated throughout a larger number of small conservation areas than would be necessary for a system of large conservation areas. Small conservation areas have a greater ratio of edge to interior, generating relatively more edge effect than large reserves. This would be taken into consideration during the design of this alternative.

The LCR MSCP will identify areas along the historic floodplain for conservation. In order to achieve habitat restoration and creation objectives, a variety of engineering techniques would be evaluated that focus on restoring core areas off the mainstem of the Colorado River. These engineering techniques could include existing irrigation systems, wells, pumps, weirs, wing-walls, grade control structures, bankline/levee modification, diversion dams, conveyance canals, percolating or permeable dike structures, and other applicable flow diversion and routing techniques.

The riparian conservation strategy would also include a preservation component to complement the restoration component. Preservation would focus on existing habitat where target species are breeding successfully. These areas would be located near areas being considered for conservation and restoration.

### **Management**

Smaller conservation areas would require more intensive and extensive

management to counteract edge effects. There would likely have to be more trapping and removal of cowbirds because they would be able to parasitize nests in these small habitat patches. Recreational users may impact the smaller habitat patches to a greater extent than larger habitat patches, necessitating an active recreational user management program. Vegetation successional stages and application of water would be highly managed to replicate natural ecosystem processes.

Fires would be more likely to completely destroy a small conservation area than a large one, increasing the need for fire prevention and suppression. As with all the alternatives under consideration, adaptive management would be a cornerstone of the overall management strategy under this alternative.

### **Habitat-Based Approach**

The habitat-based approach would simultaneously address the needs of the covered species by incorporating the components of the ecosystems (e.g., quantity and quality of breeding habitat, wintering, and dispersal habitat) which would contribute to the recovery and persistence of the target species.

Habitat-based conservation will integrate the ecology of species and ecosystems. The conservation is based on protecting the capacity of an ecosystem to support and maintain a balanced, integrated, adaptive community having a species composition, and diversity comparable to that of other natural habitats in that region.





### **Corridors**

The larger number of conservation areas would require a larger number of corridors compared to Alternative 1. Corridors would occur within existing habitat.

### **Monitoring**

All of the covered species would be monitored using a combination of habitat and species monitoring. Select species including those that are federally threatened or endangered would be monitored directly. A subset of other covered species would be monitored concurrently with the habitat to validate the habitat monitoring approach.

### **Aquatic Strategy**

### **Main Theme**

The aquatic strategy includes augmentation of fish populations in reservoirs and isolated refugia to maintain genetic diversity. No introduction or augmentation of native fish into Colorado mainstem from the refugia is proposed in this alternative. Fish reared in hatcheries and released into reservoirs would be of a size to maximize survival.

### **Isolated Refugia**

Several aquatic refugia would be created which are hydraulically isolated from the mainstem of the Colorado River, but within the historic floodplain of the LCR. The primary reasons for the physical separation is to isolate native fish from non-native predators.

As in Alternative 1, this alternative includes the provision to re-establish extirpated fish species into refugia consistent with species recovery goals and criteria, with potential regulatory provisions incorporated to minimize resource or recreational user conflicts.

### **Non-native fish control strategy**

Minimal non-native control would be implemented under this alternative, because native fish would not be introduced to the mainstem of the Colorado River.

### **Management**

Small ponds have less likelihood of containing a diversity of habitats used by more age classes of fish than large backwaters, maximizing the need for active management of these areas.

### **Native Aquatic Species Management and Research Center**

In this alternative, a native aquatic species management and research center (Center) would be built which would be focused around the construction of a hatchery large enough to meet production goals of native fishes for restoring their populations in the reservoirs of the LCR. After the demand for juvenile fish decreases, the Center would be used to conduct research on fish. This proposed Center would be used to study and captive breed target species of amphibians and invertebrates.

This Center would also contain administrative offices, a visitor's center, and aquarium.



## Fact Sheet: Alternative 3 – Habitat Preservation/ Creation



### Summary

Similar to Alternatives 1 and 2, the riparian conservation strategy of this alternative uses a habitat-based approach through preservation and creation of habitat anywhere within the species' breeding range in the United States. Fifty-four species are proposed for coverage under take authorizations issued under this alternative. An additional forty-three species would have research and monitoring programs implemented and they would be evaluated for coverage under this alternative in the future.

The aquatic strategy in this alternative utilizes augmentation of native fish populations in Lake Mohave and Lake Havasu, and establishment and maintenance of populations in the Upper Salt and other lower Colorado River tributaries through renovation of habitat, stocking of fish, and removal of non-native fish.

### Riparian Conservation Strategy

#### Main Theme

Target species would be protected primarily by conserving habitat anywhere within the species' breeding range in the United States according to the following set of priorities:

1. Preservation of existing habitat:
  - (a) within LCR floodplain using a combination of existing habitats and lands in and out of agricultural production;

- (b) tributaries of the LCR;
  - (c) other areas within the breeding range of covered species in the United States;
  - (d) take advantage, where appropriate, of cooperative activities with related/adjacent programs.

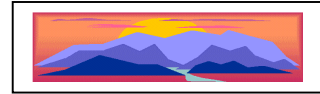
2. Enhancement of degraded habitat not currently functioning as breeding habitat:

- (a) within LCR floodplain using a combination of degraded lands and voluntary conversion of agricultural lands;
  - (b) tributaries of the LCR;
  - (c) other areas within the breeding range of covered species in the United States;
  - (d) take advantage, where appropriate, of cooperative activities with related/adjacent programs.

3. Creation of breeding habitat using restoration techniques:

- (a) within LCR floodplain using a combination of degraded lands and voluntary conversion of agricultural lands;
  - (b) tributaries of the LCR;
  - (c) other areas within the breeding range of covered species in the United States;
  - (d) take advantage, where appropriate, of cooperative activities with related/adjacent programs.

Lands for preservation would be found within the known breeding range of the target species that contain, or with



proper management, would contain suitable habitat in which target species would successfully breed and persist in the landscape.

As an example, studies have indicated that approximately 58,000 acres of land throughout the breeding range of the southwestern willow flycatcher may be available for acquisition and subsequent preservation. This habitat would need to be supplemented with other habitat for species residing only within the lower Colorado River historic floodplain.

Although this alternative focuses on off-river habitat preservation, areas within the historic floodplain of the Colorado River would also be evaluated and considered for conservation. In order to achieve habitat restoration and creation objectives within the historic floodplain of the Colorado River or other areas, a variety of engineering techniques would be evaluated that focus on restoring core areas off the mainstem of the Colorado River. These engineering techniques could include existing irrigation systems, wells, pumps, weirs, wing-walls, grade control structures, bankline/levee modification, diversion dams, conveyance canals, percolating or permeable dike structures, and other applicable flow diversion and routing techniques. It is not envisioned that these engineering techniques would be implemented on land acquired for the purpose of preserving existing high quality habitat, although these techniques may be needed to achieve enhancement or restoration objectives on other lands outside the LCR floodplain.

### **Management**

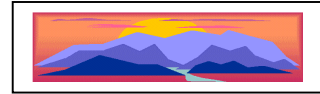
This alternative would take advantage of cooperative activities with related/adjacent programs in the off-site locations. This could decrease some of the direct management responsibility along the Colorado River.

Populations of some of the covered species would have to be managed more intensively to maintain their persistence if the LCR no longer functions as a source population. Additionally, some species may have a localized distribution (e.g., Colorado River cotton rat) which may not have historically existed off of the mainstem or its tributaries. Species such as these would require on-site restoration of habitat to take advantage of existing populations within the LCR floodplain. Conservation opportunities would represent the variety of habitats used by the various species of interest such as backwaters, marshes, and forests. As with all the alternatives under consideration, adaptive management would be a cornerstone of the overall management strategy under this alternative.

### **Habitat-Based Approach**

The habitat approach would simultaneously address the needs of the covered species by incorporating the components of the ecosystems (e.g., quantity and quality of breeding habitat, wintering and dispersal habitat) which would contribute to the recovery and persistence of the target species.

Habitat-based conservation will integrate the ecology of single species and ecosystems. It is conservation based on



protecting the capacity of an ecosystem to support and maintain a balanced, integrated, adaptive community having a species composition and diversity comparable to that of other natural habitats in that region.

### **Corridors**

The closer a management area is to the LCR, the higher the probability that habitat corridors can be maintained between them and the Colorado River.

### **Monitoring**

All of the covered species would be monitored using a combination of habitat and species monitoring. Select species including those that are federally threatened or endangered would be monitored directly. A subset of other covered species would be monitored concurrently with the habitat to validate the habitat monitoring approach.

### **Aquatic Strategy**

#### **Main Theme**

The aquatic strategy includes maintaining adult populations in Lake Mohave and Lake Havasu. These populations would be stocked with reared fish of a size to maximize survival.

The aquatic strategy also includes protection and augmentation of fish populations away from the mainstem of the Colorado River, such as in the Upper Salt, the Virgin, and the Bill Williams Rivers.

### **Instream stocking**

Stocking of fish into the Colorado River tributaries would include restoring and maintaining habitat quality. This includes water quality, structural characteristics, vegetation, predation and competition.

### **Non-native fish control strategy**

Non-native fish control strategies would focus on protecting the integrity of refugia and site-specific actions in reservoirs and off-River habitats.

Options for control of non-native species include:

- development of focused commercial harvest or physical removal strategies for specific sites and species, consistent with applicable laws and regulations;
- liberalized harvest limits for nonnative fish in certain reaches of the LCR;
- control of giant salvinia;
- use of non-endangered native fish as bait to minimize the introduction of non-native bait fish into the LCR.

### **Management**

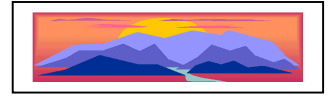
This alternative would take advantage of opportunities to participate in related/adjacent programs in the off-site locations. This could decrease some of the direct management responsibility along the Colorado River.

### **Native Aquatic Species Management and Research Center**

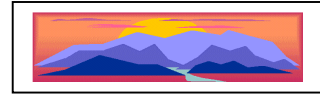
In this alternative, a native aquatic species management and research center (Center) would be built which would be focused around the construction of a

## **Fact Sheet: Alternative 3 – Habitat Preservation/ Creation**

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hatchery large enough to meet production goals of native fishes to restore their populations in the LCR and the tributaries. After the demand for juvenile fish decreases, the Center would be used to conduct research on fish. This Center would be used to study and captive breed target species of amphibians and invertebrates. This Center would also contain administrative offices, and aquarium.



### Summary

This alternative is a species-based approach that works toward recovery on an individual species basis. This alternative addresses about 12 species, including 5 listed species and 7 species that are most likely to be listed.

Elements of Alternatives 1 and 2 are incorporated to meet the conservation goals on a case-by-case basis.

The aquatic strategy in this alternative utilizes augmentation of native fish populations in reservoirs, creates isolated refugia, and allows for periodic reconnection of the refugia to the river system.

### Riparian Conservation Strategy: Limited Species MSCP

#### Main Theme

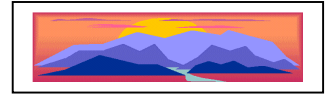
This alternative would focus on working toward recovery of listed species, and those species likely to be listed.

The LCR MSCP is continuing to evaluate the appropriate amount of acreage for riparian restoration. The range of acreage in the other alternatives is driven primarily by the needs of several species with large territory requirements, which are also either federally-listed (southwestern willow flycatcher) or likely to be listed soon (yellow-billed cuckoo). Therefore, acreage estimates for riparian restoration are not likely to be significantly different for the species covered under this alternative compared to Alternatives 1

and 2, with the possibility of less mesquite habitat required to meet the conservation goals. However, the actual acreage required would depend on the suite of species covered under this alternative. Conservation areas would be located along the mainstem of the Colorado River and throughout its historic floodplain. Some of the historic floodplain is being used for agriculture and could be available for voluntary restoration to native habitat. Figure 1 illustrates the location of potential restoration sites as well as estimated restoration acreage at selected sites.

The LCR MSCP will identify areas along the historic floodplain for conservation. In order to achieve habitat restoration and creation objectives, a variety of engineering techniques would be evaluated that focus on restoring core areas off the mainstem of the Colorado River. These engineering techniques could include existing irrigation systems, wells, pumps, weirs, wing-walls, grade control structures, bankline/levee modification, diversion dams, conveyance canals, percolating or permeable dike structures, and other applicable flow diversion and routing techniques.

The riparian conservation strategy would also include a preservation component to complement the restoration component. Preservation would focus on existing habitat where target species are successfully breeding. Preferably, these areas would be located near areas being considered for conservation and restoration.



### Management

Management would focus on restoring populations of target species along the LCR project area. Restoration of species would require protection and restoration of their habitat in pieces large enough to buffer edge effects. Conservation areas would contain a mixture of habitat types.

As with all the alternatives under consideration, adaptive management would be a cornerstone of the overall management strategy under this alternative.

### Species-Based Approach

Priorities for conservation would be based on management that would benefit each species individually. Habitat used throughout the life stages of each target species would be considered as the focus of conservation efforts.

### Corridors

The primary function of corridors is to increase the movement of target species between areas of suitable habitat. Individuals may not spend much time in corridors, but they must be of a minimum quality to be used at all. Corridors decrease the isolation of habitat pieces, which increases the persistence of the wildlife species. The types of corridors would be those which are appropriate to the species of interest.

### Monitoring

The status and trend of each covered species would be monitored directly.

### Aquatic Strategy

#### Main Theme

The aquatic strategy includes augmentation of fish populations in reservoirs and the mainstem of the Colorado River to develop and maintain populations at target levels. This includes minimal manipulation to maintain positive population growth and genetic diversity. The aquatic strategy also includes the use of isolated refugia within the historic floodplain that are periodically re-connected to the mainstem of the Colorado River. Fish reared in hatcheries and released would be of a size to maximize survival.

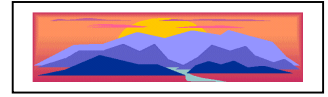
#### Isolated Refugia

To enhance fish populations, several aquatic refugia would be created which are hydraulically isolated from the mainstem of the Colorado River, but within the historic floodplain of the LCR. The primary reasons for the physical separation is to isolate young native fish from non-native predators. Reared fish would grow out in these backwaters and then moved into the mainstem from time-to-time.

Some refugia would be stocked with larval or juvenile fish that would grow to adults and contribute to that population. Individuals may be moved between backwaters to meet management goals.

#### Instream stocking

Stocking of native fish into the mainstem of the Colorado River would require restoring and maintaining habitat quality



within the mainstem. This includes water quality, structural characteristics, vegetation, and predation and competition from non-natives.

Habitat enhancement projects include:

- retention of washfans to provide sediment to water
- development of connected slow water areas (e.g., flooded bottomlands)
- increased habitat diversity

This alternative includes the provision to re-establish extirpated fish species consistent with species recovery goals and criteria, with regulatory provisions incorporated to minimize resource or recreational user conflicts.

### **Non-native fish control strategy**

Non-native fish control strategies would focus on protecting the integrity of refugia and site-specific actions in reservoirs and mainstem habitats.

Options for control of non-native species at this point include:

- development of focused commercial harvest or physical removal strategies for specific sites and species, consistent with applicable laws and regulations;
- liberalized harvest limits for nonnative fish in certain reaches of the LCR;
- control of giant salvinia;
- use of non-endangered native fish as bait to minimize the introduction

of non-native bait fish into the LCR.

### **Management**

Large backwaters have a higher likelihood of containing various habitats used by more age classes of fish than small backwaters. Additionally, large backwaters would contain more of the ecological components and processes than small backwaters, minimizing the need for active management of these areas.

### **Native Aquatic Species Management and Research Center**

In this alternative, a native aquatic species management and research center (Center) would be built which would be focused around the construction of a small hatchery used to produce native fishes in conjunction with existing hatcheries. This Center would utilize the existing system of hatcheries which produce razorback suckers and bonytail chubs as satellite facilities and/or partner with agencies already growing fish to contract with the Center. After the demand for juvenile fish decreases, the Center would be used to conduct research on fish. This Center would also be used to study and captive breed target species of amphibians and invertebrates. Additionally, the Center could contain administrative offices, a visitor's center, aquarium, and teaching facilities in support of the LCR MSCP.